

Wireless Systems

FM Solutions for Cochlear Implants

FM Guide for Cochlear Implant and Baha Fitters



PHONAK
hearing systems

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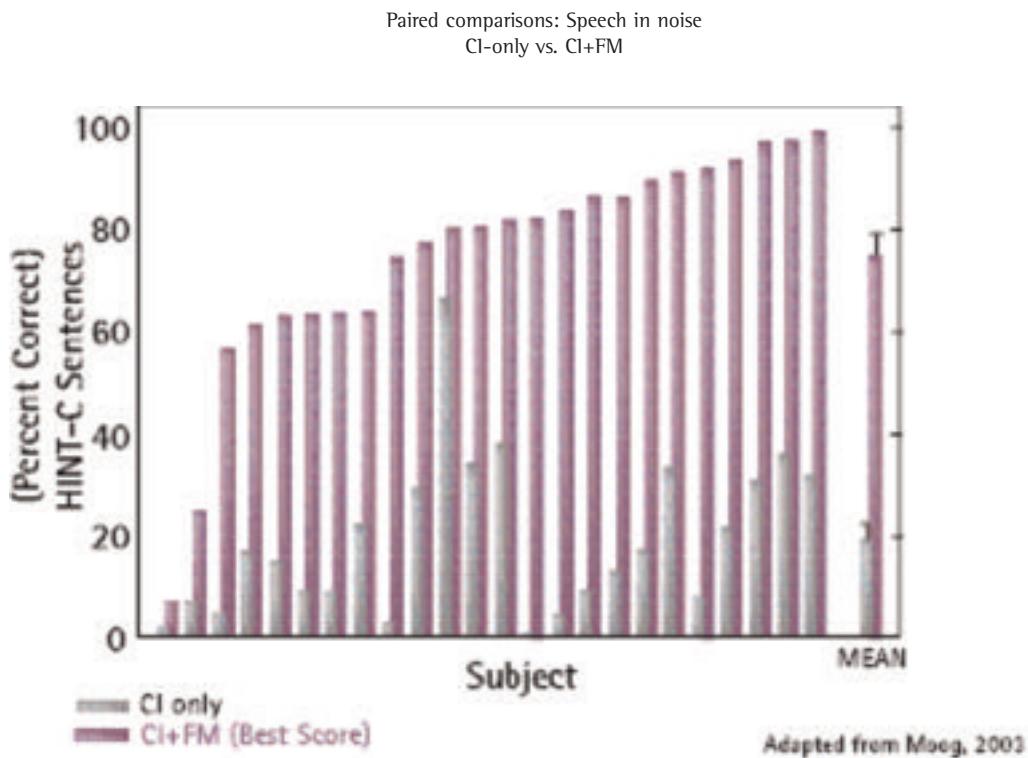
Why FM for Cochlear Implants

FM systems are able to improve the signal-to-noise ratio and thus the user's ability to understand speech in noise. Three major factors that influence the signal-to-noise ratio and the quality of the speech signal are: background noise, reverberation, and distance. By delivering the signal of interest via FM (radio waves), the strength and quality of the sound remains constant across the distance from the speaker to the hearing impaired individual. FM systems consist of a transmitter with the microphone and a receiver, which picks up the signal via radio waves directly from the transmitter.

Individuals with Cochlear Implants experience the same difficulty as hearing aid users in challenging listening environments. These situations usually involve distance from a main sound source (someone with a soft voice), unfavorable positioning in a room with background noise, or listening to a TV, radio or computer. It is well documented that improving the signal-to-noise ratio (SNR) for cochlear implant recipients through the use of an FM system improves speech recognition significantly in the presence of background noise.

The MicroLink FM System dramatically improves performance in noise by providing a much higher SNR (by transmitting the speaker's voice via FM directly to the listener). On top of that multi-microphone technology, high resolution noise cancellation and Smart Noise Blocker technology improve intelligibility and comfort even further.

Figure 1



Use of an FM System in conjunction with the cochlear implant system resulted in significant improvement in speech understanding in noise. The grey bars represents performance with the CI only in noise and the Purple bars represents the Best Score obtained when using the CI + FM system.

Transmitters for Cochlear Implants

The choice of transmitter is most commonly based on where the implant user is primarily using the FM system.



SmartLink is the first communication device to incorporate multiple solutions into one instrument. It offers three microphone settings and bluetooth link for hands-free cell phone use. It provides the most versatile and high tech access to communication.



ZoomLink offers three microphone settings for optimal reception angle. ZoomLink is very easy to use. As in SmartLink, auxiliary mic and audio inputs are available.



EasyLink provides an easy-to-use lavalier-style option, ideal for use at home or at leisure. The FM channel is dispenser changeable and the transmitter synchronizes the receiver at start-up. Auxiliary mic and audio inputs are also available.

Telcom is most commonly used at home or in the office, working directly with the telephone and any audio device such as the television, radio, or computer. This allows the user to watch television or listen to music without turning up the volume. It will switch from an audio device to the telephone when it rings.



Campus SX is designed for use in educational systems. The teacher wears the Campus SX on his or her belt with a lapel or MicroBoom microphone. The Campus SX like the MicroMLxS receiver has frequency flexibility.



Campus SX TT allows wireless TeamTeaching, where two teachers address a classroom at the same time. The second teacher also wears a transmitter, e.g. ZoomLink or Campus SX. This is also popular option in classrooms where the students with CIs would benefit from a pass around microphone.

MicroLink Receivers for Cochlear Implants

The miniaturized MicroLink receivers are available in different configurations depending on the speech processor. All multi-frequency MicroLink receivers include a digital frequency synthesizer and allow Direct Frequency Synchronization (DFS) with the Phonak transmitters and Automatic Frequency Synchronization (AFS) with the WallPilot.



The MicroLink CI S has a plug-in connection for the MicroMLxS receiver. This allows for universal FM use with all compatible speech processors.



The MicroLink Freedom is the world's first and only design integrated multi-frequency FM receiver. It is compatible with Cochlear's Nucleus Freedom BTE.



The Nucleus Freedom in bodyworn configuration can be equipped with the MicroMLxS. A special cable from Cochlear is required.



The 3G MicroLink adapter with MicroMLxS provides an earlevel FM. The MicroMLxS receiver attaches directly to the adapter on the Cochlear ESPrit 3G BTE processor giving freedom from cables.



The iConnect with MicroMLxS offers Auria recipients wireless, earlevel FM access. This special earhook attaches to the Auria so that users can plug the universal MicroMLxS receiver directly into their processor.



Neurelec (MXM). The MicroLink receiver can be attached directly to the Digi SP'K and Digisonic BTE speech processors from Neurelec (MXM)

Frequency Flexibility

The key Phonak FM systems use digital frequency synthesizers. The various MicroLink receivers are frequency flexible. This allows the user to change frequencies or channels, as easily and often as needed. With this break-through multi-frequency technology, Phonak successfully meets the demands for flexibility and practicality made by today's world. One convenient way to use the system is to set the frequency of the Campus SX and then use that transmitter, with the push of a button, to set the receiver to the same frequency. SmartLink, ZoomLink and EasyLink automatically synchronize at start-up nearby receivers to matching channels.

Not only are these products synthesized, but they are also programmable. This provides convenience to both the user and the audiologist. The default frequency of each receiver can be changed as needed. The transmitters can be programmed to have up to 40 different frequencies available, if needed. For the user friendly FM Successware programming software and training, please contact your Phonak FM representative.



MicroLink Frequencies

MicroLink systems include state-of-the-art narrowband FM frequencies, designed for the specific needs of the cochlear implant user. They operate in the 169-176 MHz (H-Band) and 216 MHz (N-Band) range. All the multi-frequency transmitters and receivers can be programmed easily and quickly with the FM Successware. Use only frequencies which are legally allowed in your country.



Fitting FM Products

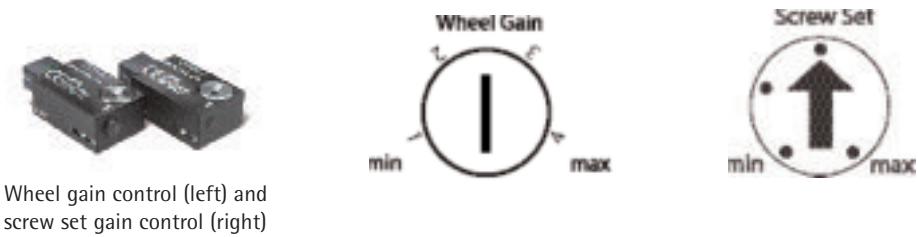
MicroLink CI S: Overview



MicroLink CI S Gain Control

The MicroLink CI S interface has a screw-set or wheel gain control. It is recommended that the gain is set to the minimum position for the initial system hookup. Gain can be increased by rotating the control in the clockwise direction. Once the receiver is plugged into the speech processor, some adjustment of the CI Interface MicroLink CI S gain and/or the cochlear implant speech processor may be required. Speech testing in quiet using the FM transmitter only should yield similar results as the same test presented through the CI headpiece microphone. If results are poorer through the FM systems, it may be necessary to increase FM level with the gain control on the side of the MicroLink CI S interface. Retest until the input level of the FM signal is optimized for speech discrimination. If this level is exceeded the patient may begin to experience some distortion and performance will deteriorate.

For children, the screw-set may be preferred, so that gain can be set without concern that the control will be changed inadvertently. Adults may prefer to have the volume control wheel for adjustment in different environments.



Audio Mixing

Audio mixing is the ability to keep the CI microphone active when the FM system is being used. On some of the earlier models speech processors, the cochlear implant microphone is deactivated when the direct audio-input is utilized. This prohibits users from hearing others in the room as well as their own voice when listening to FM. The processors that do not have built-in audiomixing capability include early model Spectra and S-series devices. Neurelec offers the audiologist the possibility to set, for each type of processor, different configurations of audio mixing between the headpiece microphone and the FM system. Ratio ranges from 0 to 100% (microphone/FM). For each configuration it is possible to set a gain function for both inputs as required by the patient. It is also possible to turn off the microphone to concentrate on the sound from the FM system only, although a 30/70 ratio would be more commonly used: the patient will get the benefit from the FM system but remains connected to environmental sounds.

MicroLink Channel

Each multifrequency MicroLink receiver comes with a preprogrammed default channel. Every time the system is turned on, it will come on to this default. If there is a need to temporarily change that channel, this can be done by "synchronizing" the receiver with the transmitter or WallPilot to a different channel. This change is only temporary, as the receiver will come back on to the default channel when it has been turned off. The default channel can be reprogrammed internally if necessary with the Phonak FM Successware.

MicroLink FM Advantage

The MicroLink receivers come with an internal gain setting of 10dB. With most hearing instruments, this provides an optimal loudness, or "FM Advantage" for the FM signal over environmental inputs. In some cases with hearing instruments and cochlear implants, this internal gain needs to be adjusted. Gain changes can be made with the FM Successware.

Patch Cables

In order to achieve predicted performance with your MicroLink CI and cochlear implant, the correct patch cable must be used to connect the devices. Please refer to the following list to confirm that you are utilizing the correct cable.

Blue #10	Nucleus Spectra 22 Nucleus ESPrit BTE Nucleus ESPrit 3G BTE Clarion S-series	
White #12	MED-EL CIS PRO+ MED-EL TEMPO+ (remote battery pack)	
Blue-Red Long #13	Clarion Platinum BTE Clarion CII BTE	
Red #14	MED-EL TEMPO+ (remote battery pack)	
Orange #16	Nucleus SPrint	
Blue-Red Short# 18	Clarion PSP (platinum body worn)	
Black #11	Clarion 1.2 series	
Blue-White #21	Baha Classic	

Fitting

For each processor, the fitting will consist of 2 basic steps. First, the loudness of the FM system compared to the environmental input must be optimized. With the MicroLink CI S, this can be done with the external gain control. With the MicroMLxS, this must be done with the internal gain level of the device. A range of -6 to +24dB is available with +10dB as the default FM advantage. The experienced FM advantage may be different than +10dB, depending on microphone sensitivity settings in the speech processor. The second step is confirming FM benefit in noise. Adjustments in the relationship between the FM input and CI headpiece microphone (or environment) may be made to improve performance with the FM System compared to the CI alone. The adjustment is accomplished differently depending on the implant.

Processor Sensitivity (Cochlear)

The sensitivity control on the Nucleus devices with audio mixing is a crucial variable in FM benefit. This includes most 22 Nucleus sound processors and all sound processors for Nucleus 24 sound processors. This sensitivity adjustment controls the input from the headpiece microphone, ultimately varying the audio mixing ratio between the cochlear implant microphone and the Wireless FM system. This control allows the users to adjust the FM advantage to match the conditions. Adults are very comfortable adjusting their FM advantage based on current conditions. For children, one sensitivity level should be employed in typical FM/classroom use. In order to optimize the setting, test the patient's speech understanding in noise (i.e. g. at +5 dB SNR). If the user's performance is not improved compared to using cochlear implant alone, the ratio between the FM input and the headpiece microphone may need to be adjusted. In general, reducing processor sensitivity will result in a greater FM advantage as a result of reduced input through the cochlear implant microphone. Adults will often tolerate a very low sensitivity with the FM signal in order to focus on the primary signal. Children often prefer higher sensitivity with the FM signal in order to continue monitoring their environment and their own voice.

If processor sensitivity is not adjustable and a volume map is fit with the FM system, FM advantage is set at one point (controlled by the fixed sensitivity point in the map). The benefit can be evaluated in the same method described above. The Nucleus Freedom sound processor employs a software selected audio mixing ratio, which can be adjusted to control the amount of headpiece microphone attenuation when the FM signal is being used.

Audio Mixing (Advanced Bionics)

Advanced Bionics uses fixed audio mixing functions in the map to control the ratio of headpiece microphone compared to the FM input. In theory both signals are being received at full strength. In practice, however, a slight reduction of -3dB is applied to both signal pathways in order to avoid loudness summation. Given that the input level may be higher from the audio-appliance (e.g. from the microphone placement of a transmitter at 5 - 15 cm inches from the teacher's voice) the signal-to-noise advantage should be maintained. Sound input to the HI microphone should not be perceptibly different with the auxiliary audio device connected or disconnected. In some cases a 30/70 mixing function will be needed to achieve FM benefit. In a map with this ratio, less gain than normal will be applied to headpiece inputs but the listener will remain in touch with the environment. Normal gain is still applied to the FM in 30/70. Note that when the FM is not in use, the listener should return to a 50/50 map to return input levels to normal.

Sensitivity (MED-EL)

The sensitivity control on the Tempo processor will not affect the audiomixing ratio. When the FM is in use, the patient will experience equal levels of headpiece microphone and FM input (with a slight reduction to account for loudness summation). If the sensitivity control is turned to off (turned counter-clockwise past 11:00 position until click is felt), the headpiece microphone will be turned off, resulting in the FM only condition.

Fitting

1. Remove the Freedom battery rack by pulling it out of the controller.
2. Insert three 675 batteries designed for use with cochlear implants into the MicroLink Freedom battery rack.
3. Plug the MicroLink Freedom into the controller.
4. Press the round power button to power up the speech processor.
5. Use a program that is set to normal signal processing (rather than beam, auto sensitivity or ADRO)
6. The Freedom processor will automatically detect the presence of the MicroLink Freedom. The recipient will hear the environment through the headpiece microphone and the FM combined.
7. Test the patient's speech recognition in quiet at normal sensitivity with the CI alone and then through the FM system only (out of range of the headpiece microphone). Performance should be similar between these two conditions. It is not recommended to change the FM level of MicroLink Freedom with the FM Successware.
8. Repeat speech recognition testing in noise. Performance with the FM should be significantly improved over the implant only condition. Cochlear recommends using a sensitivity level of around 12 for normal use. If FM benefit is not documented in the noise test, it may be necessary to reduce the sensitivity by pressing the left side of the  button. The sensitivity level will be displayed in the LCD panel with the letter S.

9. A default mixing ratio of 3:1 is used with the Nucleus Freedom. This reduces the headpiece microphone by 9dB when the MicroLink Freedom is in use. This ratio can be adjusted in the implant audiologist's programming software. In some cases the 2:1 or 1:1 ratios may be preferred for more normal environmental audibility, or higher ratios up to 10:1 for an "FM only" setting. The headpiece microphone reduction is maintained when the FM transmitter is switched off and MicroLink Freedom goes into squelch.

10. When FM is not in use, press both sides of the increase/decrease button  to toggle back to M only. This will resume normal head piece microphone function. To re-engage the FM, toggle with the  button until "EA" flashes on the display and the M remains active.

Freedom Listening Check:

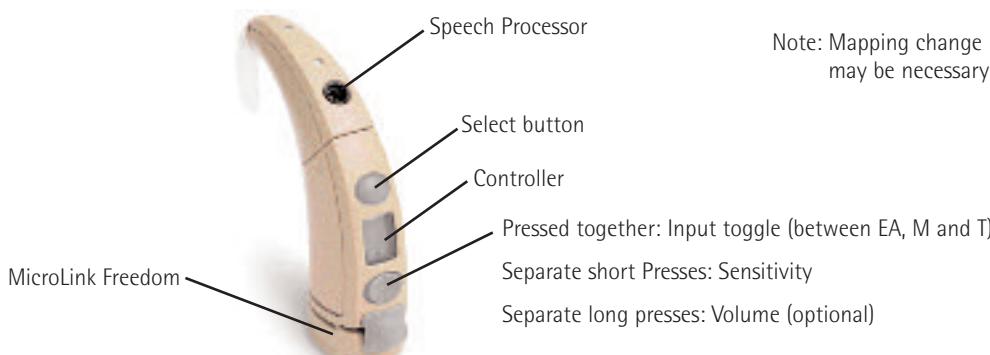
1. Attach the Cochlear monitoring phones to the receptacle in the bottom of the MicroLink Freedom. Turn the system on by pressing the select button on the Nucleus Freedom. Ensure that the MicroLink Freedom is plugged into the speech processor, it has been recognized by the processor (EA), and normal FM settings are being used.
2. While speaking into the transmitter, listen to the signals from the headpiece mic and FM system.

Note: The signal quality of the monitoring phones does not necessarily reflect the sound quality experienced by the implant user.

Required Parts:

1. Nucleus Freedom
2. MicroLink Freedom

Note: Mapping change may be necessary

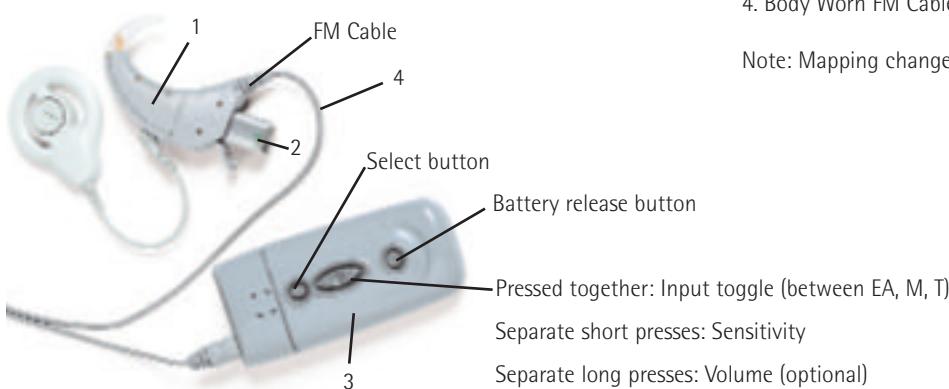


Fitting

1. If you haven't already done so, remove the earlevel controller by twisting it from the processor.
2. Twist on the Body Worn FM cable. Plug the cable into the proper receptacle on the body worn controller. Attach the MicroMLxS to the ear-level end of the FM cable and set the receiver in the 2 green dot position.
3. Turn the body worn controller on by pressing and holding the top button. Ensure that an X appears in the upper right corner of the display. If not, press and hold both sides of the increase/decrease button until "EA" flashes and an X appears in the display.
4. Test the patient's speech recognition in quiet at normal sensitivity with the CI alone and then through the Wireless FM system only (out of range of the headpiece microphone). Performance should be similar between these two conditions. If the FM is too loud or too soft, the FM programming software and interface from Phonak may be required to optimize the level of FM input.
5. Repeat speech recognition testing in noise. Performance with the FM system should be significantly improved over the implant only condition. Cochlear recommends using a sensitivity level of around 12 for normal use. If FM benefit is not documented in the noise test, it may be necessary to reduce the sensitivity by pressing the left side of the  button. The sensitivity level will be displayed in the LCD panel with the letter S.

Freedom Listening Check:

1. A hearing aid with a working audioshoe or the MicroLink headset checker may be used to check the system by speaking into the transmitter and listening for interference-free, clear sound quality.
2. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.



Required Parts:

1. Speech processor
2. MicroMLxS
3. Body Worn Controller
4. Body Worn FM Cable

Note: Mapping change may be necessary.



Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])

Fitting

1. Turn the 3G, transmitter and MicroMLxS FM receiver off.
2. The switch on the bottom of the processor should be in the 'M' (microphone) position.
3. Set the 3G adapter to the FM+M position and attach to the bottom of the 3G (may need to remove the clear plastic port cover on the bottom of the BTE).
4. Set the MicroMLxS in the double green dot position and attach to the 3G MicroLink adapter. If the patient prefers the FM signal to be softer, the single green dot position may be used.
5. Switch the processor into program 1 (P1 on the dial). It is preferred that the sensitivity control is enabled in P1. It may be necessary to visit the mapping audiologist for this change. With a sensitivity-enabled map, the user can alter the rotary dial up or down to increase or decrease the amount of signal from the CI microphone, relative to the amount of signal from the FM system, as necessary. Cochlear recommends that the microphone sensitivity level of the Esprit 3G is set to 21-24dB when it is used with an FM system. Use the programming software to find the number on the dial that equates to this level. It will vary slightly between each speech processor. When this dial number is known, the 3G user should be counseled to use this setting with their FM system as it will result in an appropriate mix of FM and headpiece microphone. Anything below 1.5 on the dial will be FM only.
6. Turn the FM transmitter on.



Required Parts:

1. MicroMLxS
2. FM 3G adapter
(Cochlear part number Z60409)

Note: mapping changes are recommended with the ESPrit 3G



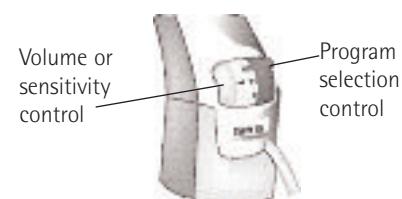
7. Determine speech recognition in quiet with the CI alone at normal sensitivity. Repeat through the FM transmitter out of the CI mic range. If scores with the FM signal are poorer, increase the gain of the MicroMLxS using FM programming software and a FM programming interface until comparable performance is achieved.
8. Determine speech recognition with the FM system in noise. Decrease the mic sensitivity until significant FM benefit is demonstrated.
9. It is recommended that the monitoring earphones are disabled in P1 to conserve power for the FM system. Failure to do this may result in intermittency for CI or FM. They may still be used in P2.

Troubleshooting - Perform a listening check

1. There is a socket on the side of the adapter to plug in the monitoring earphones. When the earphones are plugged in and activated the map, they allow a hearing person to check the sound being received from the Esprit 3G microphone and the FM system simultaneously. Typically P2 is designated for the monitoring phones. If you do not hear anything when using the monitoring earphones turn the processor off and on to P2 and try again. If still nothing, review the recipients map or contact your CI audiologist.
2. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.

Note 1: The earphone cable may pick up some interference and therefore may be noisier than the actual input to the recipient.

Note 2: If the 3G adapter is loose on the 3G, please take precautions not to lose the attachment. The BTE mic lock will help to maintain the connection.



Fitting

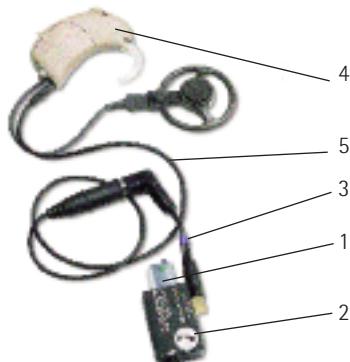
1. Turn the speech processor, FM receiver, and transmitter off.
2. Attach the ESPrat audio cover to the processor.
3. Attach the accessories adapter cable to the audio cover.
4. Plug the blue connector cable into the CI and adapter cable.
5. Plug the MicroMLxS into the MicroLink CI S. Leave the receiver in the double green dot position.
6. Turn on the speech processor, transmitter and MicroLink CI S in that order to avoid transient sounds.
7. Select a program that allows for sensitivity adjustment.
8. Determine speech recognition in quiet with the CI alone at normal sensitivity. Repeat test with FM system. If scores are poorer with the FM System, increase the gain of the MicroLink CI S until comparable performance is achieved.
9. Determine speech recognition with the FM System in noise. Decrease mic sensitivity until significant benefit is demonstrated.
10. Most recipients wear their sensitivity control between 3.5 - 4.5. When using the MicroLink System, optimum sensitivity is about 18dB. The Cochlear programming software will let you know what dial position corresponds to this level. This setting will produce a beneficial audiomixing ratio between the headpiece mic and the wireless signal.

Troubleshooting - Perform a listening check

1. Plug the receiver and adapter into a test amplifier, e.g. RadioShack speaker, with the blue patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Put the MicroMLxS receiver in the double green dot position.
4. Turn on the transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.
5. Follow the CI audiologist's recommendations for conducting a listening check of your speech processor.
6. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.



Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])



Required Parts:

1. MicroMLxS
2. MicroLink CI S
3. Blue cable
4. ESPrat audiocover
(Cochlear part number Z77015/6/7 beige/brown/black)
5. Accessory adapter cable (Cochlear part number Z77081)
Note: mapping changes are recommended with the ESPrat



MicroLink CI S plugged into the RadioShack speaker



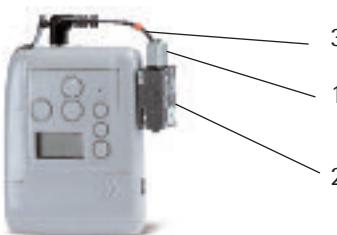
Switch positions
Program Selector



Rotary control positions
Volume/Sensitivity Control

Fitting

1. Turn speech processor, FM receiver and transmitter off.
2. Plug the orange cable into the MicroLink CI S.
3. Plug the MicroMLxS into the MicroLink CI S. Leave the receiver in the double green dot position.
4. Attach the MicroLink CI S to the external input socket on the speech processor.
5. Turn on the speech processor, FM transmitter and MicroLink CI S in that order to avoid transient sounds.
6. Select a program that allows for sensitivity adjustment.
7. Determine speech perception in quiet with the CI alone at normal (12) sensitivity. Repeat test with the FM system. If scores are poorer with the FM system, increase the gain of the MicroLink CI S until comparable performance is achieved.
8. Determine speech perception with the FM system in noise. Decrease mic sensitivity in two-unit increments until significant FM benefit is demonstrated.



Required Parts:

1. MicroMLxS
2. MicroLink CI S
3. Orange cable



Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])



MicroLink CI S plugged into
the RadioShack speaker

Troubleshooting

Listening check #1

The environmental and FM signal can be heard simultaneously through the monitoring phones to confirm function of the headpiece mic and the FM system.

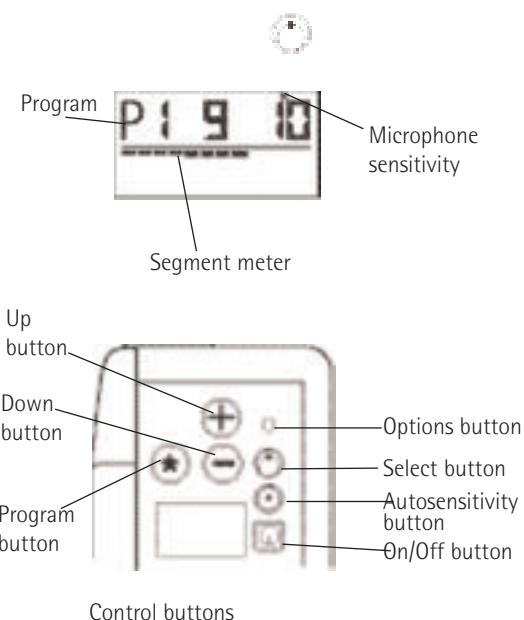
Listening check #2

1. Plug the receiver and adapter into a test amplifier, e.g. RadioShack speaker, with the orange patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Put the MicroMLxS receiver in the double green dot position.
4. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.
5. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.

Listening check #3

1. Follow your audiologist's recommendations for conducting a listening check of your speech processor.

NOTE: You may choose to disable the volume control. If both the microphone sensitivity and the volume controls are available, press the Select button to alternate between them.



Control buttons

Fitting

1. Turn speech processor, FM receiver and transmitter off.
2. Plug the blue cable into the MicroLink CI S.
3. Plug the MicroMLxS into the MicroLink CI S. Leave the receiver in the double green dot position.
4. Attach the adapter to the external input socket on the speech processor.
5. Turn on the speech processor, FM system transmitter and MicroLink CI S in that order to avoid transient sounds.
6. Use the processor in the N setting.
7. Determine speech perception in quiet with the CI alone at normal (4-5) sensitivity. Repeat test with FM system. If scores are poorer with the FM signal, increase the gain of the MicroLink CI S until comparable performance is achieved.
8. Determine speech perception with the FM signal in noise. Decrease mic sensitivity in single-unit increments until significant FM benefit is demonstrated. Typically maximum benefit is achieved at 2-3.5.

Troubleshooting

Perform a listening check

1. Plug the receiver and adapter into a test amplifier, e.g. Radio Shack speaker, with the blue patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Put the MicroMLxS receiver in the double green dot position.
4. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.
5. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.
6. Follow your audiologist's recommendations for conducting a listening check of your speech processor.



Required Parts:
 1. MicroMLxS
 2. MicroLink CI S
 3. Blue cable



MicroLink CI S plugged into the RadioShack speaker



Headset Checker
 (Phonak part number 052-3126
 [110V] and 052-3122 [220V])

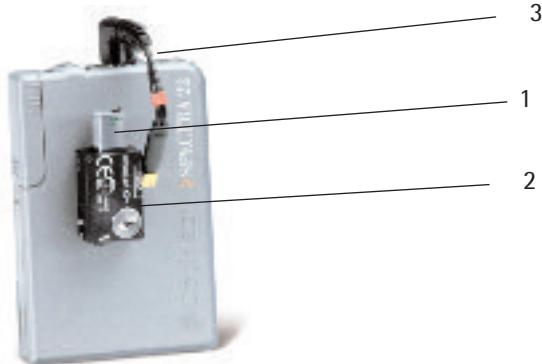
Fitting

1. Turn speech processor, FM receiver and transmitter off.
2. Plug the blue cable into the MicroLink CI S.
3. Attach the MicroLink CI S to the external input socket on the speech processor.
4. Turn on the speech processor, FM transmitter and MicroLink CI S in that order to avoid transient sounds.
5. Use the processor in the N setting.
6. Determine speech perception in quiet with the CI alone at normal (4-5) sensitivity. Repeat test with the FM system. If scores are poorer with the FM, increase the gain on the MicroLink CI S adapter until comparable performance is achieved.
7. The CI microphone will be deactivated when an external device is plugged in. For environmental input while utilizing FM, patient must plug the MicroLink CI S external lapel microphone into the MicroLink CI S.

Troubleshooting

Perform a listening check

1. Plug the receiver and adapter into the RadioShack speaker with the blue patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of FM system.
4. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.
5. Follow your audiologist's recommendations for conducting a listening check of your speech processor.



Required Parts:

1. MicroMLxS
2. MicroLink CI S
3. Blue cable



Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])



MicroLink CI S adapter plugged
into the RadioShack speaker

Fitting

1. Turn the MicroMLxS or MLxS off.
2. When using MLxS ensure that the pins are in the horizontal orientation.
3. Turn the Auria off by sliding the battery back.
4. Remove standard earhook by twisting it off.
5. Hold the iConnect at the base and firmly press until it clicks onto the Auria.
6. Insert a size 10 zinc air battery into the iConnect (+ side up).
7. Turn the FM transmitter on.
8. Turn the volume down on the Auria to avoid transient sounds.
9. Turn the Auria on to a program with a 50/50 audio mixing ratio.
10. Turn the MicroMLxS receiver on to the single green dot position.
11. Gradually turn the volume on the Auria up to the normal level (usually 12:00).
12. Verify that the FM signal is loud but comfortable for the listener. This may be done by determining speech recognition in quiet through the FM only. Confirm that performance is similar to the CI only condition. If not, it may be necessary to change the gain programmed in the MicroMLxS from the +10 default. Further information for practical fittings please see chapter "Programming FM systems").
13. Verify that the FM is beneficial in noise. If not, it may be necessary to use a program with a 30/70 mixing ratio.

Required Parts:

1. MicroMLxS
2. iConnect™ (also available from Phonak)

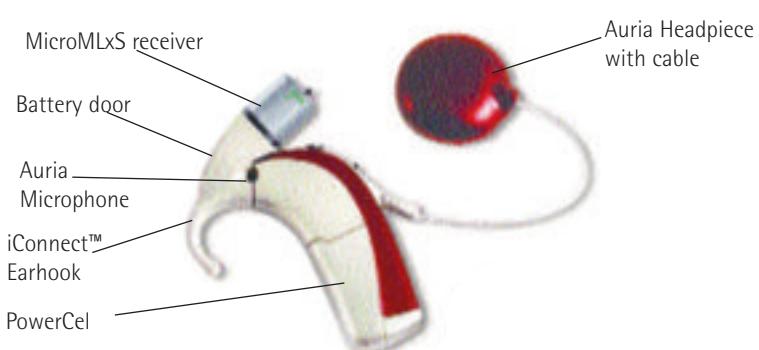
Note: mapping change
may be necessary

Listening Check/Troubleshooting

1. Follow your CI audiologist's recommendations for checking performance of the Auria.
2. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.

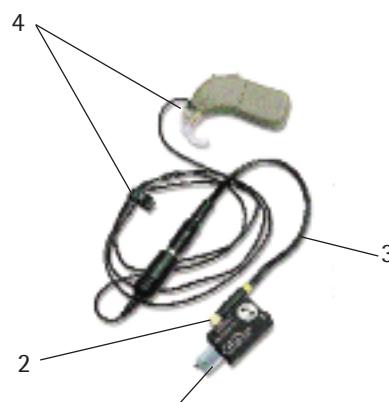


Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])



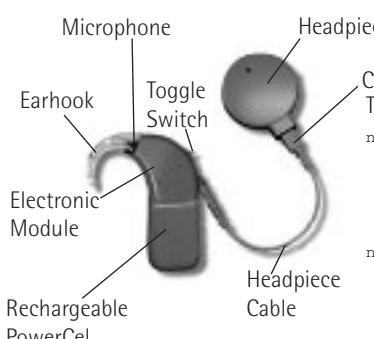
Fitting

1. Turn speech processor, FM receiver and transmitter off.
2. Plug the MicroMLxS into the MicroLink CI S. Keep the MicroMLxS in the double green dot position.
3. Connect the blue-red long cable to the MicroLink CI S.
4. Attach the auxiliary earhook to the speech processor.
5. Plug the blue-red long cable into the auxiliary earhook cable.
6. Turn on the FM transmitter, MicroLink CI S and speech processor in that order to avoid transient sounds.
7. Gradually increase the gain of the MicroLink CI SI to a comfortable level.
8. Determine speech recognition ability in quiet with the FM signal. Ensure that results are similar to implant alone condition. MicroLink CI S gain may need further adjustment.
9. Determine speech recognition in noise with the FM system. The default microphone mixing ratio in the map is 50/50 (CI headpiece mic and FM). The ratio may need to be changed to 30/70 (CI headpiece mic and FM) to realize FM benefit. If this change is needed, the 30/70 ratio should be implemented in the third program and this program will need to be used with FM.



BTE can be turned off or reset by sliding the PowerCel off

Required Parts:
 1. MicroMLxS
 2. MicroLink CI S
 3. Blue-Red long cable
 4. Auxiliary audio earhook with cable
 (part number CI-5705-10/20 standard/small)
 Note: mapping change may be necessary



Troubleshooting Performing a Listening Check

1. Plug the receiver and adapter into a test amplifier, e.g. Radio Shack speaker, with the blue-red patch cable.
2. Insert a battery into the MicroLink CI S adapter and turn it on.
3. Put the MicroMLxS receiver in the double green dot position.
4. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.
5. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.
6. Follow your audiologist's recommendations for conducting a listening check of your speech processor.



Headset Checker
 (Phonak part number 052-3126
 [110V] and 052-3122 [220V])

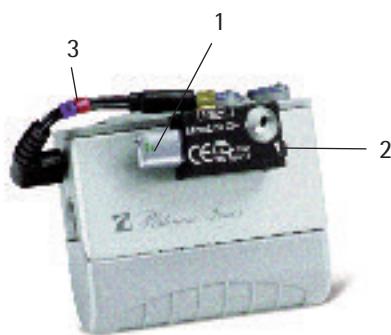


MicroLink CI S plugged into the RadioShack speaker

Connector
 Toggle switch:
 □ You can change from one program to the next by pressing and holding the toggle switch in the upward direction for more than one second.
 □ To decrease the volume or sensitivity you must press and quickly release the toggle switch in the downward direction

Fitting

1. Turn speech processor, FM receiver and transmitter off.
2. Insert the blue-red short cable into the MicroLink CI S.
3. Plug the MicroMLxS into the MicroLink CI S. Leave the receiver in the double green dot position.
4. Plug the MicroLink CI S into the external input socket on the speech processor.
5. To avoid transient sounds, turn on the FM transmitter, then MicroLink CI S, then speech processor in that order.
6. Gradually increase the gain of the MicroLink CI S to a comfortable level.
7. Determine speech recognition ability in quiet with the FM signal. Ensure that results are similar to implant alone condition. MicroLink CI S gain may need further adjustment.
8. Determine speech recognition in noise with the FM system. The default microphone mixing ratio in the map is 50/50 (CI headpiece mic and FM). The ratio may need to be changed to 30/70 (CI head- piece mic and FM) to realize FM benefit. If this change is needed, the 30/70 ratio should be implemented in the third program and this program will need to be used with FM.



Required Parts:

1. MicroMLxS
2. MicroLink CI S
3. Blue-Red cable



MicroLink CI S plugged into the RadioShack speaker

Troubleshooting

Performing a Listening Check

1. Plug the receiver and adapter into a test amplifier, e.g. Radio Shack speaker, with the blue-red patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Put the MicroMLxS receiver in the double green dot position.
4. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.
5. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal. Follow your audiologist's recommendations for conducting a listening check of your speech processor.
6. Follow your audiologist's recommendations for conducting a listening check of your speech processor.



Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])

PSP Controls



LED Indicator

Battery status:

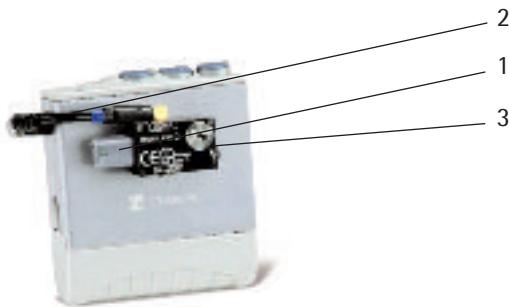
4 quick blinks	battery fully charged
2-3 quick blinks	battery sufficiently charged
1 quick blink	battery near depletion

Lock status:

LED will synchronously flash red if lock is lost
Mic/System status: Green LED flickers in response to loud input (Verifies that mic received sound, data transmitted to implant & processor received data from implant)

Fitting

1. Turn speech processor, FM receiver and transmitter off.
2. Insert the blue cable into the MicroLink CI S.
3. Plug the MicroMLxS into the MicroLink CI S. Leave the receiver in the double green dot position.
4. To avoid transient sounds, turn on the FM transmitter, then MicroLink CI S, then speech processor in that order.
5. Gradually increase the gain of the MicroLink CI S to a comfortable level.
6. Determine speech recognition ability in quiet with the FM signal. Ensure that results are similar to implant alone condition. MLCI gain may need further adjustment.
7. The CI microphone will be deactivated when an external device is plugged in. For environmental input while utilizing FM, patient must plug the MicroLink CI S external lapel microphone into the MicroLink CI S.



Required Parts:

1. MicroLink CI S
2. Blue cable
3. MicroMLxS



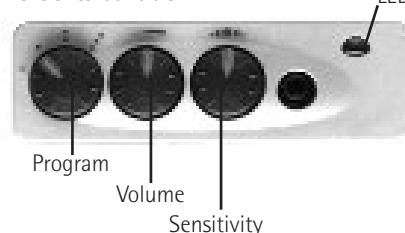
MicroLink CI S plugged into the RadioShack speaker

Troubleshooting

Performing a Listening Check

1. Plug the receiver and adapter into a test amplifier, e.g. RadioShack speaker, with the blue patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of FM system.
4. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal. Follow your audiologist's recommendations for conducting a listening check of your speech processor.
5. Follow your audiologist's recommendations for conducting a listening check of your speech processor.

S-Series Controls



LED (Light-Emitting-Diode):

To assess battery status, turn the speech processor on and observe the number of red blinks:

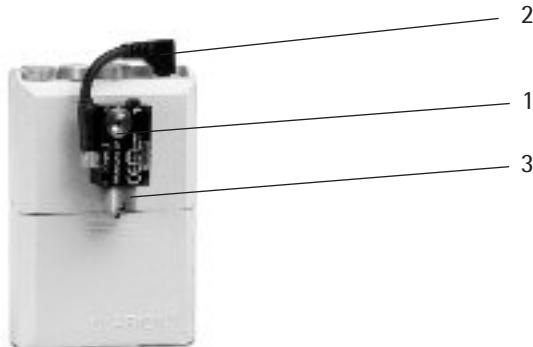
4 quick blinks	indicates the battery is fully charged
2 to 3 quick blinks	indicates the battery is sufficiently charged to power the system
1 quick blink	indicates the battery charge is nearly depleted

A loss of lock will be displayed as a synchronous flashing of the red light

The green light will appear as the system hits compression

Fitting

1. Turn speech processor, FM receiver and transmitter off.
2. Insert the black cable into the MicroLink CI S adapter.
3. Plug the MicroMLxS into the MicroLink CI S. Leave the receiver in the double green dot position.
4. To avoid transient sounds, turn on the FM transmitter, then MicroLink CI S, then speech processor in that order.
5. Gradually increase the gain of the MicroLink CI S to a comfortable level.
6. Determine speech recognition ability in quiet with the FM signal. Ensure that results are similar to implant alone condition. MicroLink CI S gain may need further adjustment.
7. The CI microphone will be deactivated when an external device is plugged in.



Required Parts:

1. MicroLink CI S
2. Black cable
3. MicroMLxS

Troubleshooting

Performing a Listening Check

1. Plug the receiver and adapter into a test amplifier, e.g. RadioShack speaker, with the blue patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.
4. If the system is working with the blue cable, exchange the black #11 cable and try again with the processor.
5. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.
6. Follow your audiologist's recommendations for conducting a listening check of your speech processor.



Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])



MicroLink CI S plugged into the RadioShack speaker with Blue cable.

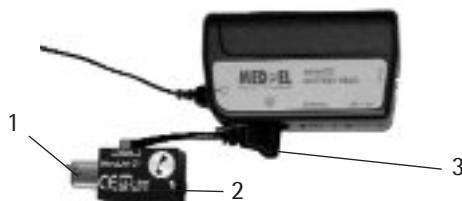
Fitting

1. Connect the Remote Battery Pack (RBP) to the speech processor.
- 2 Turn RBP, MicroLink CI S and transmitter off.
3. Connect the white cable to the MicroLink CI S.
4. Plug the MicroMLxS into the MicroLink CI S. Leave the receiver in the double green dot position.
5. Plug the MicroLink CI S into the remote battery pack.
6. Switch the RBP into MIX-Mode and turn the RBP on.
7. Turn on the FM system and gradually increase FM gain to a comfortable level.
8. Determine speech perception ability with the FM signal in quiet and in noise.

Troubleshooting

Performing a Listening Check

1. Plug the receiver and adapter into a test amplifier, e.g. RadioShack speaker, with the white patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Put the MicroMLxS receiver in the double green dot position.
4. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.
5. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.
6. Follow your audiologist's recommendations for conducting a listening check of your speech processor.



Required Parts:

1. MicroMLxS
2. MicroLink CI S
3. White cable



Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])



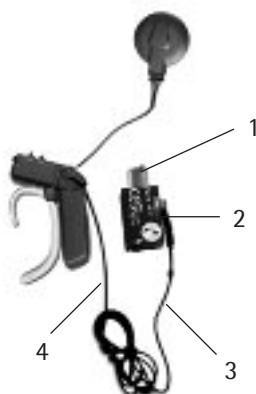
MicroLink CI S plugged into the
RadioShack speaker

Fitting

1. Turn speech processor, FM receiver and transmitter off.
2. Connect the red cable to the MicroLink CI S and attach to the speech processor.
3. Turn the speech processor on.
4. Turn the FM system on and set the MicroLink CI S gain to 3-3.5.
5. Determine speech perception ability with FM signal in quiet and in noise.

How to Connect

1. Open cover at the angled part of the device by pulling straight back (A) and lifting upward (B).
2. Insert the connector of the cable into the socket as shown. The red dot on the cable connector should be on top. When positioned correctly, the connector slides into the socket easily. Be careful not to force the connector into the socket the wrong way.
3. Gently lower the cover until it rests on the connector (C). There may be a "click" when you do this, which means that the connector is securely locked in to the socket. This ensures maximum protection of the connector.



Required Parts:

1. MicroMLxS
2. MicroLink CI S
3. Red cable
4. Blue cable for testing with RadioShack speaker



Headset Checker
(Phonak part number 052-3126
[110V] and 052-3122 [220V])



MicroLink CI S plugged into the RadioShack speaker with Blue cable.

Troubleshooting Performing a Listening Check

1. Plug the receiver and adapter into a test amplifier, e.g. RadioShack speaker, with the blue patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Put the MicroMLxS receiver in the double green dot position.
4. Turn on the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of FM system.
5. If the system is working with the blue cable, exchange the red #14 cable and try again with the processor.
6. Follow your audiologist's recommendations for conducting a listening check of your speech processor. You may purchase the microphone test devices from MED-EL for a speech processor test.
7. To check the FM system, remove the MicroMLxS and plug it into a working hearing aid and audioshoe or a Phonak MicroLink Headset checker. Turn on the transmitter and listen for a clear signal.

Fitting

The Digi SP'K processor provides different programmes that can be configured for use by any auxiliary system. The first use of the Phonak FM system will require a visit to the audiologist to adapt these programmes to different sound environments following the procedure below:

1. Switch off the speech processor, FM receiver and transmitter.
2. Plug the MicroMLxS FM receiver directly into the auxiliary ("AUX") input of the processor.
3. Switch the processor on in the position defined for the use of the auxiliary system, and switch on the MicroLink receiver (preferably the single green dot position). The processor automatically detects the presence of the receiver.
4. Use the implant programming software to adapt these specific programmes (copy the programmes and authorise the auxiliary input). Adapt the appropriate audio mixing of FM and headpiece microphone.
5. Determine speech perception in quiet with the CI alone and then through the FM system. Performances should be similar between these two conditions. If the FM is too loud or too soft, it may be necessary to modify the input gain (microphone and/or FM) until comparable performance is achieved.
6. Determine speech perception with the FM system in noise. The audio mixing ratio may need to be changed to reach FM benefit.

Required Parts:

1. MicroMLxS
2. Digi SP'K processor



Listening Check/Troubleshooting

1. Follow the recommendations of the audiologist for checking the performance of the Digi SP'K processor.
2. The environmental and FM signals can be checked using the dedicated function in the implant programming software.
3. Use a working hearing aid and audioshoe and plug the MLxS to check the FM system. Speak into the transmitter and listen for clear sound quality.

Note: Modification of the frequency can be performed as needed.



Fitting

The Digi SP and Digisonic BTE processors provide two additional programmes (P3/P4) dedicated to any auxiliary input connexion. The first use of the Phonak FM system will require a visit to the audiologist to adapt these programmes to different sound environments following the procedure below:

1. Switch off the speech processor, FM receiver and transmitter.
2. Plug the MicroMLxS FM receiver directly into the auxiliary ("AUX") input of the processor.
3. Switch the processor on in P1 or P2, and switch on the MicroMLxS receiver (preferably in the single green dot position). The processor automatically detects the presence of the receiver and switches from the standard programs P1/P2 to the specific P3/P4 to be set for the first use.
4. Use the implant programming software to adapt these specific programs (copy P1/P2 into P3/P4 and authorise the auxiliary input). Adapt the appropriate audio mixing of the FM and headpiece microphone.
5. Determine speech perception in quiet with the CI alone and then through the FM system. Performances should be similar between these two conditions. If the FM is too loud or too soft, it may be necessary to modify the input gain (microphone and/or FM) until comparable performance is achieved.
6. Determine speech perception with the FM system in noise. The audio mixing ratio may need to be changed to reach FM benefit. Note: The sensitivity potentiometer remains accessible to optimise hearing performances while using the FM system.

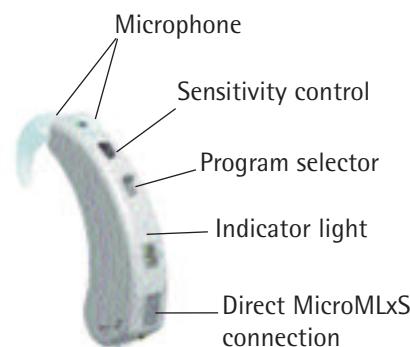
Listening Check/Troubleshooting

1. Follow the recommendations of the audiologist for checking the performance of the Digi SP or Digisonic BTE processor.
2. The environmental and FM signals can be checked using the dedicated function in the implant programming software.
3. Use a working hearing aid and audioshoe and plug in the MicroMLxS to check the FM system. Speak into the transmitter and listen for clear sound quality.

Note: Modification of the frequency can be performed as needed.

Required Parts:

1. MicroMLxS
2. Digi SP'K processor



Fitting

1. Turn hearing aid, FM receiver and transmitter off.
2. Plug the blue-white cable into the MicroLink CI S.
3. Plug the MicroMLxS into the MicroLink CI S. Leave the receiver in the double green dot position.
4. Attach the blue-white cable to the audio adapter.
5. Plug the audio adapter into the hearing aid.
6. Turn on the hearing aid, FM transmitter and MicroLink CI S.
7. Determine speech perception in quiet with the hearing aid alone. Repeat the test with the FM system. If scores are poorer with FM, increase the gain of the MicroLink CI S until comparable performance is achieved.
8. Determine speech perception in noise. Increase FM gain in the MicroMLxS receiver until significant FM benefit is demonstrated.

Required Parts:

- MicroMLxS
- MicroLink CI S
- Blue-White cable
- Cochlear audio adapter (part number 90065 purchased through Cochlear)
- Blue cable for testing with Radio Shack speaker.

Troubleshooting

Performing a Listening Check

1. Plug the receiver and into a test amplifier, e.g. Radio Shack speaker, with the blue patch cable.
2. Insert a battery into the MicroLink CI S and turn it on.
3. Put the MicroMLxS receiver in the double green dot position.
4. Turn on the the FM transmitter. While speaking into the transmitter, listen for the clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.
5. If the system is working with the blue cable, exchange the blue-white cable and try again with the hearing aid.
6. Follow your audiologist's recommendations for conducting a listening check of your hearing aid.

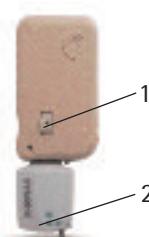


MicroLink CI S plugged into the RadioShack speaker with Blue cable.

Baha Compact

Fitting

1. Turn hearing aid, FM receiver and transmitter off.
2. Plug receiver into Baha Compact hearing aid so that the white circled pin on the receiver lines up to the red circle on the hearing aid.
3. Turn on the hearing aid, FM transmitter and receiver. The single green dot is FM only; the double green dot is FM+M.



Required Parts:
1. Baha
2. MLxS with BAHA modification

Troubleshooting

Performing a Listening Check

1. Plug the receiver into the MLxS Baha listening adapter (part number 052-3002). This adapter can be purchased from Phonak. Plug the adapter into the MicroLink checker (part number 052-0036) or into a spare hearing aid with audioshoe.
2. Turn on the checker, receiver and transmitter. While speaking into the transmitter, listen for a clear signal with minimal background noise. This checker will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.

Fitting

1. Turn hearing aid, FM receiver and transmitter off.
2. Attach MicroVox cord to MicroVox COM-1 receiver.
3. Plug MicroVox cord into audio coupler.
4. Plug audio coupler into audio adapter.
5. Plug audio adapter into hearing aid.
6. Turn on hearing aid, FM transmitter and receiver.
7. Adjust volume of MicroVox COM-1 for significant FM benefit.

Required Parts:

- MicroVox COM-1 (with headphones for troubleshooting)
- Cochlear audio adapter (part number 90067, purchased through Cochlear)
- MicroVox cord (part number 52114)
- Stereo-to-Stereo audio coupler (part number 274-1555)

Troubleshooting

Performing a Listening Check

1. Plug headphones into the MicroVox COM-1.
2. Turn on FM transmitter and receiver.
3. While speaking into the transmitter, listen for a clear signal with minimal background noise. This check will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.

Baha Divino

Fitting

1. Turn the hearing aid, FM receiver and transmitter, off.
2. Plug receiver into the Baha Compact Divino hearing instrument so that the white circled pin on the receiver lines up to the red circle on the hearing instrument.
3. Turn on the hearing aid, FM transmitter and receiver. The single green dot is FM only; the double green dot is FM+M.

Required Parts:

1. Baha
2. MLxS

Troubleshooting

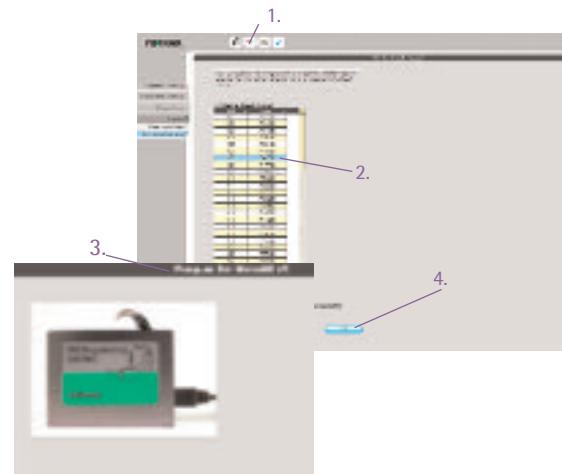
Performing a Listening Check

1. Plug the receiver into the MLxS Baha listening adapter (part number 052-3002). This adapter can be purchased from Phonak. Plug the adapter into the MicroLink checker (part number 052-0036) or into a hearing instrument with audioshoe.
2. Turn on the checker, receiver and transmitter. While speaking into the transmitter, listen for a clear signal with minimal background noise. This checker will not reflect the sound quality that the patient will hear but will confirm function and transmission of the FM system.

Programming MicroMLxS or MicroLink Freedom with FM Successware

I. Changing the default channel of a MicroMLxS receiver

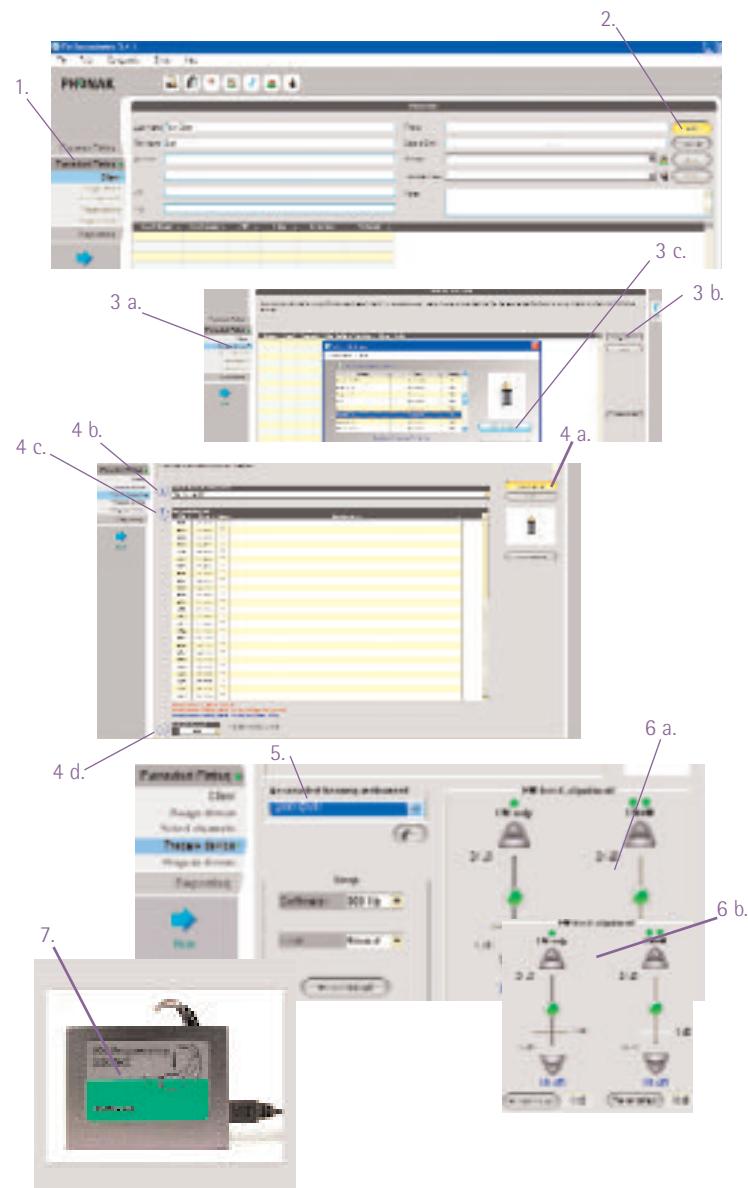
1. Click on the flag icon at the top of the screen.
2. Select the new channel that you would like the MicroMLxS to turn onto.
3. Insert batteries so that receiver and speech processor or MicroLink CI S are working. Plug everything together and turn all parts on.
4. Place receiver and processor or MicroLink CI S into the toaster (devices turned on) and press the "Go" button.



II. Changing the internal gain (FM Advantage) of MicroMLxS receiver

1. Click on the Extended Fitting menu along the left-hand side of the screen
2. Enter in a client name. Click "Add."
3. Go down one menu to "Assign device." Click the "Assign device" button on the right and choose your device from the list ("Assign device") or detect your device ("Detect device", below "Assign device"). Then click "Select device."
4. Click on the next menu down, "Select channels." Click on "Create a New Set." Type a name in field #1 and select your desired channel from the list next to field # 2. Select the same channel from the pull-down list in field # 3.
5. Click on the next menu down, "Prepare device." Select the associated hearing device (MicroLink CI S, MicroLink, Freedom, etc.) or choose "unknown."
6. Click on the "FM advantage modification" button. Adjust gain as needed with the slider bar(s).
7. Click on the last menu, "Program device." Insert batteries and connect parts so that the FM is powered. Place powered FM in toaster and click "Save Now."

For more information about using the Phonak FM Successware, please contact your local Phonak FM Specialist.



Online resources

The Phonak homepage with information for professionals and consumers:
www.phonak.com

Your online comprehensive FM support tool for schools:
www.eSchoolDesk.com

Latest set-up tips for FM systems in combination with
cochlear implants and hearing instruments:
www.phonak.com\FM_Configurator

Check quickly if your C.I. or hearing instrument is FM compatible:
www.phonak.com\mlx

Cochlear
www.cochlear.com

Advanced Bionics
www.advancedbionics.com

MED EL
www.medel.com

MXM
www.mxmlab.com